CLAIMS:

1. A method for forming a high temperature superconductor (HTS) condcutor or cable comprising transposed conductor elements comprising:

forming a layer of an HTS on one or more substrates and cutting the substrate(s) with an HTS layer thereon or at least one substrate into a multiple number of generally longitudinally extending serpentine conductor elements each comprising a series of element portions which periodically change direction relative to one another in a plane of the substrate, or cutting one or more planar substrates to form a multiple number of generally longitudinally extending serpentine substrate elements each comprising a series of element portions which periodically change direction relative to one another in a plane of the substrate, so that said serpentine conductor elements are cut from the larger substrate back-to-back with similarly oriented element portions of the serpentine conductor elements being cut from common parts of the larger substrate across a width of the substrate and forming a layer of an HTS on a surface of the serpentine substrate elements, and

interleaving such serpentine conductor elements to form a longitudinally extending transposed conductor HTS conductor or cable.

2. A method according to claim 1 including forming a layer of an HTS on one or more planar substrates and cutting the substrate(s) to form a multiple number of generally longitudinally extending serpentine conductor elements each comprising a first series of element portions having a generally common longitudinal axis and a second series of element portions having a generally common longitudinal axis which is spaced from the longitudinal axis of said first series of element portions in a plane of the substrate, with connecting portions of the conductor elements between.

3. A method according to claim 1 including cutting one or more planar substrates to form a multiple number of generally longitudinally extending serpentine substrate elements each comprising a first series of element portions having a generally common longitudinal axis and a second series of element portions having a generally common longitudinal axis which is spaced from the longitudinal axis of said first series of element portions in a plane of the substrate, with

connecting portions of the substrate elements between, and forming a layer of an HTS on a surface of the serpentine substrate-elements.

4. A method according to claim 2 wherein the element portions of said first series of conductor elements and the element portions of said second series of conductor elements are longer than said connecting portions between.

5. A method according to claim 3 wherein the element portions of said first series of substrate elements and the element portions of said second series of substrate elements are longer than said connecting portions between.

6. A method according to claim 1 including forming a layer of an HTS on one or more substrates and cutting the substrate(s) with the HTS layer thereon to form a multiple number of generally longitudinally extending serpentine conductor elements each comprising a first series of spaced generally parallel element portions which extend at an angle across a longitudinal axis of the conductor element in a first direction and a second series of spaced generally parallel element portions which extend across the longitudinal axis of the conductor element in an opposite direction.

7. A method according to claim 6 including cutting the substrate(s) with the HTS layer thereon to include connecting portions of the conductor elements between adjacent ends of each of said element portion of said first series of element portions and an element portion of said second series of element portions.

8. A method according to claim 1 including cutting one or more planar substrates to form a multiple number of generally longitudinally extending serpentine substrate elements each comprising a first series of spaced generally parallel element portions which extend at an angle across a longitudinal axis of the substrate element in a first direction and a second series of spaced generally parallel element portions which extend across the longitudinal axis of the conductor element in an opposite direction.

9. A method according to claim 8 including cutting the substrate(s) to include connecting portions of the substrate elements between adjacent ends of each said element portion of said first series of element portions and an element portion of said second series of element portions.

10. A method according to any one of claims 1 to 9 including cutting five or more of said longitudinally extending conductor or substrate elements side by side from a common substrate.

11. A method according to any one of claims 1 to 10 including interleaving the resulting serpentine conductor elements to form a longitudinally extending HTS conductor or cable in which individual conductor elements are transposed relative to other conductor elements both in the plane of the conductor elements and orthogonal to the plane of the conductor elements.

12. A method according to claim 11 including interleaving the conductor or elements so that each serpentine conductor element is transposed with an adjacent conductor element in plane, out of plane, or both, once per each said element portion of each conductor element.

13. A method according to any one of claims 1 to 12 including interleaving at least four said serpentine conductor elements to form a longitudinally extending transposed conductor HTS wire or cable.

14. A method according to any one of claims 1 to 13 including forming the layer of an HTS as a film of the HTS with Jc $>10^4$ A/cm^2 (DC, 77K, self field).

15. A method according to any one of claims 1 to 14 wherein the substrate comprises a metal or metal alloy.

16. A method according to any one of claims 1 to 15 wherein the substrate comprises a metal or metal alloy tape.

17. A method according to claim 16 wherein at least the surface of the substrate is a crystallographically aligned oxide layer.

18. A method according to any one of claims 1 to 20 including providing one or more buffer layers between the substrate and the layer of an HTS.

19. A method according to any one of claims 1 to 21 including providing an overlayer over the HTS layer.

20. A method according to claim 19 wherein said overlayer comprises a noble metal or copper or a metal alloy.

21. A method according to any one of claims 1 to 20 wherein the conductor elements have a rectangular or near rectangular cross-sectional shape.

22 A method according to claim 21 including interleaving at least some of the conductor elements with an orientation such that the HTS layers of adjacent conductor elements face and directly or indirectly electrically contact each other at points along the length of the wire or cable.

23. A method according to claim 22 including interleaving about half of the conductor elements with an orientation such that the HTS layers of adjacent conductor elements face and directly or indirectly electrically contact each other at points along the length of the wire or cable.

24. A method according to any one of claims 1 to 23 including transposing the conductor elements around a resistive core.

25. A method according to any one of claims 1 to 24 wherein the HTS is an R – Ba-Cu-O HTS where R is Y or a rare earth element.

26. A method according to claim 29 wherein the HTS comprises substantially R Ba_2 Cu_3 O_7 where R is Y, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, or Yb or a combination thereof.

27. A high temperature superconductor (HTS) conductor or cable comprising a number of transposed conductor elements which comprise a layer of an HTS on a substrate element cut in a longitudinally extending serpentine form from a larger substrate back-to-back with similarly oriented element portions being cut from common parts of the larger substrate across the width of the larger substrate.

28. An HTS conductor or cable according to claim 27 wherein said conductor elements each comprise a series of element portions which periodically change direction relative to one another in a plane of the substrate.

29. An HTS conductor or cable according to claim 28 wherein said conductor elements each comprise a first series of element portions having a generally common longitudinal axis and a second series of element portions having a generally common longitudinal axis which is spaced from the longitudinal axis of said first series of element portions in a plane of the substrate, with connecting portions of the conductor elements between.

30. An HTS conductor or cable according to claim 29 wherein the element portions of said first series of conductor elements and the element portions of said second series of conductor elements are longer than said connecting portions between.

31. An HTS conductor or cable according to claim 28 wherein said conductor elements each comprise a first series of spaced generally parallel element portions which extend at an angle across a longitudinal axis of the conductor element in a first direction and a second series of

spaced generally parallel element portions which extend across the longitudinal axis of the conductor element in an opposite direction.

32. An HTS conductor or cable according to claim 31 including connecting portions of the conductor elements between adjacent ends of each of said element portion of said first series of element portions and an element portion of said second series of element portions.

33. An HTS conductor or cable according to any one of claims 28 to 32 wherein the conductor elements are interleaved so that individual conductor elements are transposed relative to other conductor elements both in the plane of the conductor elements and orthogonal to the plane of the conductor elements.

34 An HTS conductor or cable according to claim 33 wherein each serpentine conductor or element is transposed with an adjacent conductor element either in plane, out of plane, or both, once per each said element portion of each conductor element.

35. An HTS conductor or cable according to any one of claims 28 to 34 including interleaving at least four said serpentine conductor or elements to form a longitudinally extending transposed conductor HTS wire or cable.

36. An HTS conductor or cable according to any one of claims 27 to 35 wherein the layer of an HTS is a film of the HTS with $Jc > 10^4$ A/cm^2 (DC, 77K, self field).

37. An HTS conductor or cable according to any one of claims 27 to 36 wherein the substrate is a metal or metal alloy substrate.

38. An HTS conductor or cable according to any one of claims 27 to 36 wherein the substrate is a metal or metal alloy tape.

39. An HTS conductor or wire or tape according to claim 38 wherein at least the surface of the substrate is a crystallographically aligned oxide layer.

40. An HTS conductor or cable according to any one of claims 27 to 39 including an overlayer over the HTS layer.

41. An HTS conductor or cable according to claim 40 wherein said overlayer comprises a noble metal or copper or a metal alloy.

42. An HTS conductor or cable according to any one of claims 27 to 41 including a buffer layer between the substrate and the layer of an HTS.

43. An HTS conductor or cable according to any one of claims 27 to 42 wherein the conductor elements have a rectangular or near rectangular cross-sectional shape.

44. An HTS conductor or cable according to claim 43 wherein at least some of the conductor elements are oriented such that the HTS layers of adjacent conductor elements face and directly or indirectly electrically contact each other at points along the length of the conductor or cable.

45. An HTS conductor or cable according to claim 43 wherein about half of the conductor elements are oriented such that the HTS layers of adjacent conductor elements face and directly or indirectly electrically contact each other at points along the length of the conductor or cable.

46. An HTS conductor or cable according to any one of claims 27 to 45 wherein the conductor elements are transposed around a resistive core.

47. An HTS conductor or cable according to any one of claims 27 to 46 wherein the HTS is an R-Ba-Cu-O HTS wherein R is Y or a rare earth element.

48. An HTS conductor or cable according to claim 47 wherein the HTS comprises substantially R Ba_2 Cu_3 O_7 where R is Y, Nd, Sm, Ev, Gd, Tb, Dy, Ho, Eu, Tm, or Yb or a combination thereof.

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